

# 3 Branches of the Same Tree: Art, Science and Education



A teacher's Resource Pack for  
Key Stage 2 students



Focusing on curriculum topics:  
Forces & Magnets, Light and Sound



Part 2 of 4: **Sound**



Alongside the exhibition at Pump House Gallery  
23 April - 31 May 2015

pumphousegallery

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THE BRIGHTER BOROUGH  
  
Wandsworth

# Introduction

*3 Branches of the Same Tree* brings together theories and concepts of science, art and education. The project has formed through the collaboration between three artists, three scientists and teachers from six Wandsworth-based primary schools. The aim was to create an exhibition of new work developed from research into Key Stage 2 curriculum areas of Light, Forces & Magnets and Sound. The exhibition aims to explore how art can be used as an access point into traditionally challenging areas, the outcomes of which are complemented by this Teacher's Resource Pack.

Beginning in September 2014, the project has involved each artist engaging in scientific research through close collaboration with a scientist and teachers from two Wandsworth primary schools. The process began with six working group sessions exploring the curriculum areas, where activities developed and ideas were tested out with students. Initially looking at the ways science can be taught, from January to March the artists' work developed as they applied their practice to question how the lenses of science and art affect our perception of the world.

This Resource Pack has been created alongside the artists' work as it has developed. Working with Primary Science Consultant Naomi Hiscock, Art Consultant John Tucker and Art Teacher Hazel Hardy, the activities in this Pack aim to locate the meeting point between art and science. Designed for and by Science teachers, it was vital that the art explored developed the students' scientific knowledge. As ideas were tested and checked over, the cross-overs between the practices of both scientists and artists became increasingly visible. The 18 activities bring together artists from around the world, linking those from the past and today and the work developed by the project artists. The activities not only meet the curriculum requirements but will inspire curiosity, learning and understanding of both art and science.

Artistic duo Semiconductor Ruth Jarman and Joe Gerhardt worked alongside biophysicist Ben Robinson and teachers Jane Bettles from West Hill and Jenny Taylor and Peggy Cowdry from St Anne's primary schools to explore Light. The group explored photograms by artist Man Ray, created



Designed by © Caroline Claisse

# Introduction

shadows of objects and paths of light as it reflects off surfaces. The critical moment that directed the outcome of the activities was the understanding that everything you see is reflected light. Early on in their research, Semiconductor came across a satellite called Landsat which captures images of the Earth and reflected light. Although this satellite programme has been running since 1972, in 2013 introduced a new band, 'Band 9', which captures a very small wavelength of light (1.38 microns) reflected from Cirrus clouds. Their work, *Band 9*, is an installation of light boxes presenting very high contrast, highly detailed images that capture the clouds from above and the reflected sunlight. Viewers are offered a different perspective of something familiar – the clouds from above.

Artist Alistair McClymont worked with neuroscientist Aleksandra Berditchenskaia and teachers Nancy Leeming and Nicolle Atkin from Griffin and Emma Pring and Kitty Russell from Falconbrook primary schools. Exploring students' understanding of how sound travels in vibrations, the group tested out ideas with elastic bands, specialist

technology and mark making. As the project developed, McClymont's work focused on the connection we have with sound from scientific perspectives through to its use in contemporary music. The work *One should never mistake pattern... for meaning (Function Generator)* has been set up as an ongoing project involving experiments in collaboration with Berditchenskaia, and live performances with scratch DJ and producer Prime Cuts and artist and musician Tom Richards.

Working with scientist Max Boleininger and teachers Sarah Daniell and Pat Dickens from All Saints CE and Lara Ahmoye from Hotham Primary Schools, artist Lyndall Phelps has researched the possibilities of forces and magnets. As they tested out ideas with students, Phelps became fascinated by the apparent magic of magnets. Phelps has developed a series of installations for the exhibition that invite visitors to explore and interact with the effects magnets have on their surroundings. Using specialist materials, such as powerful magnets and liquid magnets, Phelps provides opportunities to test out and explore the mysteries of magnets.

This Resource Pack is available as an online downloadable PDF. The exhibition (23<sup>rd</sup> April – 31<sup>st</sup> May) is open for school groups to visit. For more information, please contact the gallery on 020 8871 7572 or email [info@pumphousegallery.org.uk](mailto:info@pumphousegallery.org.uk)

We would like to thank all the teachers, artists and scientists involved in making this pack. We would like to thank Clare Thurman, Action Learning Facilitator, Davina Salmon, Education and Social Services Department, Wandsworth Borough Council and Ella Lewis-Williams, Project Assistant and Danielle Morris, Pump House Gallery Intern. We would also like to thank first4magnets and Beehive Coil Ltd for their support in providing materials for the exhibition.

This project has been funded by Mayor of London and London School of Excellence.



## **Pump House Gallery**

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**SOUND**

## Summary

# SOUND

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# How can we see and feel sound?

During this session, the children will discover that given sounds are associated with an object vibrating. They will examine the work by Carsten Nicolai, and Yoshimasa Kato and Yuichi Ito who have created pieces in which sound vibrations cause a water and cornflower mix to move. They will explore this idea by carrying out and discussing different activities in which vibrations can be clearly seen or felt.



## National curriculum

### **SCIENCE OBJECTIVES**

Pupils should be taught:

- ☐ To identify how sounds are made, associating some of them with something vibrating.
- ☐ To recognise that vibrations from sounds travel through a medium to the ear.

### **ART AND DESIGN OBJECTIVES**

Pupils should be taught:

- ☐ To communicate their observations of artwork by contemporary artists such as Carsten Nicolai, and Yoshimasa Kato and Yuichi Ito, linking the visual and tactile elements of pattern, shape and form.

## RESOURCES



- ☐ Tuning forks, a container of water, a table tennis ball strung on thread/string
- ☐ Elastic bands (preferably in varying widths), small to medium sized boxes
- ☐ Plastic straws and scissors
- ☐ Video clip by artist Carsten Nicolai, 'Wellenwanne Ifo'  
<https://vimeo.com/48454665>
- ☐ Video clip by artists Yoshimasa Kato & Yuichi Ito - 'White Lives on Speakers, Brain-driven Aesthetic Environment', 2007 <http://www.wlos.jp/index.html>

1 Ask the children to close their eyes and listen very closely for nearby sounds. They should count on their fingers how many different sounds they can hear.

Q Ask the children:

- a To share the sounds that they heard.
- b To say what words they could use to describe the sounds.
- c To say what they think was making each sound?

2 In pairs the children should discuss how they think we hear these sounds.

👉 Ensure the children understand that a sound-source produces the sound, which then travels to our ears so that we can hear it.

## TEACHER'S NOTE:



Explain that the object making the sound is the sound source.



3 Play the following clip by:

a Artist Carsten Nicolai, excerpts from the piece 'Wellenwanne Ifo' where sound is vibrating through water: <https://vimeo.com/48454665>.

b Yoshimasa Kato & Yuichi Ito's, 'White Lives on Speakers, Brain-driven Aesthetic Environment', 2007, where a white substance is moving from sound vibrations <http://www.wlos.jp/index.html>

👉 Before they watch the clips, ask the children to think about:



## Activity

## 2.1

## What to do

## Assessment

③ What they can see happening to the liquids in the videos by looking at the patterns being created.

④ What do they think is causing this?

④ At this stage, the children might not know what is causing the water to move. Ask them to put their fingers on their throats and hum.

🗣️ Ask the children: What do they feel?

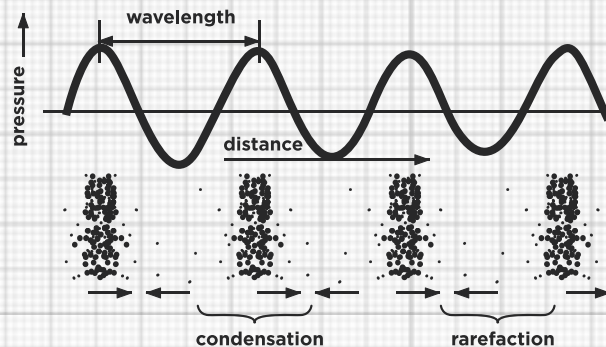
⑤ Set up the four activities on the Resource Sheets to help the children feel and see vibrations more clearly. In groups of four, each child should try out one of the activities and then return to share their experience with the rest of their group.

⑥ Ensure the children understand that the sound source causes a vibration, which then travels to our ear, causing us to hear the sound. This will be explored more in Activity 4.

### TEACHER'S NOTE:

They may use words such as a 'buzz' to describe the sensation. Establish that it is a small movement and demonstrate what this looks like by moving your hand back and forth in a rapid movement.

The word for this type of movement is a vibration; vibrations are very small and fast, and are therefore difficult to see.



### SCIENCE

☐ Can the children describe how we hear sounds, using the keywords sound source, vibration, travel, ear, and hear?

### ART AND DESIGN

☐ Can the children describe how the material in Yoshimasa Kato & Yuichi Ito's work [<http://www.wlos.jp/index.html>] is moving, using the keywords of pattern, shape and form?

☐ Can the children describe what patterns were created as the water moved, using the keywords of pattern, shape and form?

☐ Can the children associate this movement with sound vibrations?

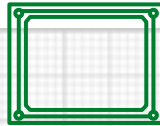


**CARSTEN NICOLAI**

[www.carstennicolai.de](http://www.carstennicolai.de)

In this work, Nicolai was interested in exploring how the frequencies of inaudible sound can affect us. Nicolai directed low-frequency sound waves (so low they could not be heard) onto the surface of water contained in a tank.

With the use of mirrors, Nicolai projected the patterns the waves create onto a projection screen. The patterns created on the water's surface make visible what would otherwise lie beyond our range of perception.



This is a theme running through much of Nicolai's work, as he often makes visible what is usually invisible, whether it be magnetic fields, radiation, subfrequency sound, gravity or microscopic structures.

Web link:

<http://www.moma.org/interactives/exhibitions/2013/soundings/artists/8/works/>



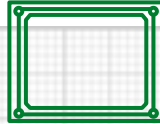
*Wellenwanne Ifo* (2012) Metal, glass, acrylic glass, mirror, audio equipment, water, light, sound. Room installation, dimensions variable. Exhibition view, Echigo-Tsumari Triennale 2012.

**YOSHIMASA KATO  
& YUICHI ITO**

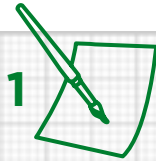
[www.wlos.jp](http://www.wlos.jp)

Yoshimasa Kato & Yuichi Ito are two Japanese artists who explore science through art. *White Lives On Speakers* was an interactive artwork that enabled spectators to see their brain waves.

An EEG recording of alpha and beta waves generated from the spectator's brain were converted and played through a speaker filled with potato starch. When stimulated by sound, this starch took on a form and a life of its own. This sculpture gave the otherwise invisible brain waves real properties.

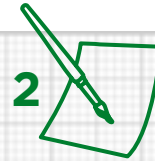


Yoshimasa Kato & Yuichi Ito, *White Lives on Speakers*,  
*Brain-driven Aesthetic Environment* (2007)

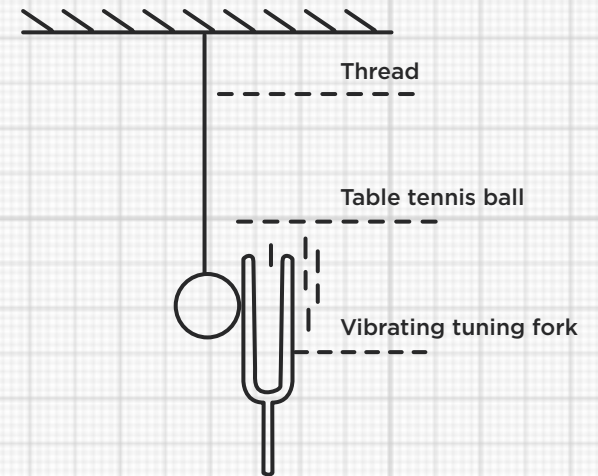
**STRAW PIPES**

- 1 Flatten the end of a straw. At this flattened end, measure to a length of 10mm. This will be the cutting length.
- 2 Cut the straw to remove the two slanted ends (or triangle shapes).
- 3 Place the cut end of the straw in your mouth, holding the straw in place, covering your teeth with your lips.
- 4 Blow forcefully. Keep practising until you make a sound.

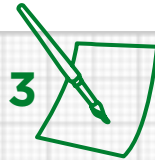
Q What do you feel?

**TUNING FORK**

- 1 Strike the tuning fork on the sole of your shoe. Look at the prongs.
- What do you see?
- 2 Gently touch the tip of the tuning fork onto the surface of the water.
- What do you see?
- 3 Slowly move the table tennis ball to touch a prong of the tuning fork.
- What do you see?

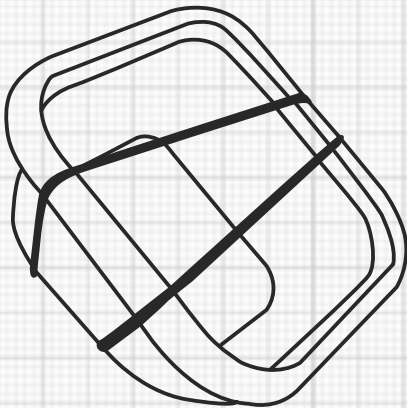




**ELASTIC BAND BOX**

- 1 Put an elastic band around a box.
- 2 Pluck the elastic band.

☞ What do you see?

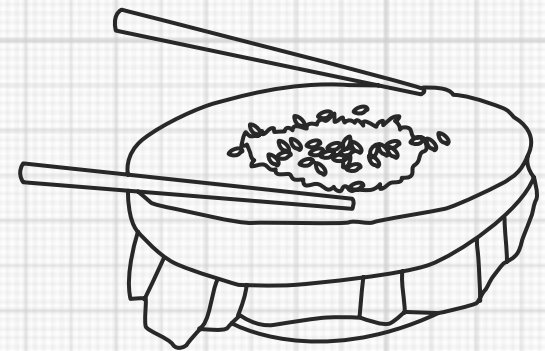
**RICE ON DRUM**

- 1 Place the rice on the drum skin.
- 2 Gently hit the drum.

☞ What do you see? What do you notice as you hit the drum harder?

- 3 Place the drum near to a set of speakers and play music loudly.

☞ What do you see?





## How do we measure sound?

During this session, the children will discover that given sounds are associated with an object vibrating. They will examine the work by Carsten Nicolai, and Yoshimasa Kato and Yuichi Ito who have created pieces in which sound vibrations cause a water and cornflower mix to move. They will explore this idea by carrying out and discussing different activities in which vibrations can be clearly seen or felt.

### National curriculum

#### **SCIENCE OBJECTIVES**

Pupils should be taught:

- ☐ To find patterns linking the volume of a sound and the strength of the vibrations that produced it.

#### **ART AND DESIGN OBJECTIVES**

Pupils should be taught:

- ☐ To explore how different materials create different sounds, and how these can be matched to ideas and intentions.
- ☐ To compare ideas, methods and approaches in their own and others' work and say what they think about them.
- ☐ To use a variety of methods and approaches to communicate observations and investigations.
- ☐ To investigate and combine tactile qualities of materials, and match these qualities to the purpose of the work.

## RESOURCES

- ☐ Containers made of different materials and in different sizes e.g. paper and plastic cups, yoghurt pots, tin cans, cardboard boxes
- ☐ Different fillings e.g. paperclips, dried pasta, cotton wool balls, rice
- ☐ Masking tape (that can be drawn on)
- ☐ Datalogger or iPads with installed sound measuring app e.g. Sound meter or Decibel 10<sup>th</sup>
- ☐ Musical instrument e.g. tambourine, drum or triangle etc.



1 Ask one child to play a musical instrument as loudly as possible. Show the children how the datalogger or iPad can be used to measure the loudness of the sound.

✎ Explain that they will be making a range of instruments (shakers) that produce sounds of different volumes.

2 Show the children the artwork by artist Zimoun. Zimoun, *138 prepared dc-motors, cotton balls, cardboard boxes 40x40x40cm*, 2011. <http://www.zimoun.net/2011-138.html>

✎ Before the children watch the film(s), ask them to think about:

- a How the work has been made?
- b Zimoun makes one object, but repeats this numerous times. What impact does it make to have the same object repeated like this?
- 3 Demonstrate how to make a simple shaker by filling a container like a box or a plastic cup and then joining this to a second container with masking tape.



Zimoun, *138 prepared dc-motors, cotton balls, cardboard boxes 40x40x40cm*, 2011. <http://www.zimoun.net/2011-138.html>

4 On the tables, make available a selection of containers in different sizes and made of different materials, together with a variety of small objects/materials to be used as fillings.

Q Ask each group to make three shakers – one that will produce a loud noise, one that will be quiet, and one that will be of medium volume.



5 Allow the children to use the datalogger or iPad app to measure the volume of each shaker. Apps like 'Sound meter' have a screenshot function. This function will allow the children to get an image of the sound levels.

6 Collate and display the datalogger's data for each shaker, and ask the children to think about how they might display the data on their shaker. For example:

a By drawing the image of the graph (using masking tape to cover the plastic container so that it can be drawn on).

b By attaching the printed screen shot to the shaker.

7 Ask the children questions such as:

a Which is the loudest/quietest shaker?

b Which two shakers produced the same volume of sound?

8 Ask the children to discuss as a class the different materials they used to make their shakers in order to determine if plastic, cardboard and tin can produce different volumes of sound.

9 Select one shaker and ask a child to play it loudly, and then more quietly. How do they do this?

Q Discuss how it makes less noise if it is shaken less strongly, i.e. the vibrations are weaker.

### SCIENCE



☐ Are the children able to interpret the results from the dataloggers and to work out which instrument/shaker is the loudest/quietest?

☐ Can the children demonstrate and talk about how to make a louder or quieter sound using the shakers?

☐ Can the children explain why larger vibrations produce louder sounds?

### ART AND DESIGN



☐ Can the children discuss how the design of their 3D sculpture affects the sound? How does the size of the shaker affect it? How does the material it is made from affect the sound?

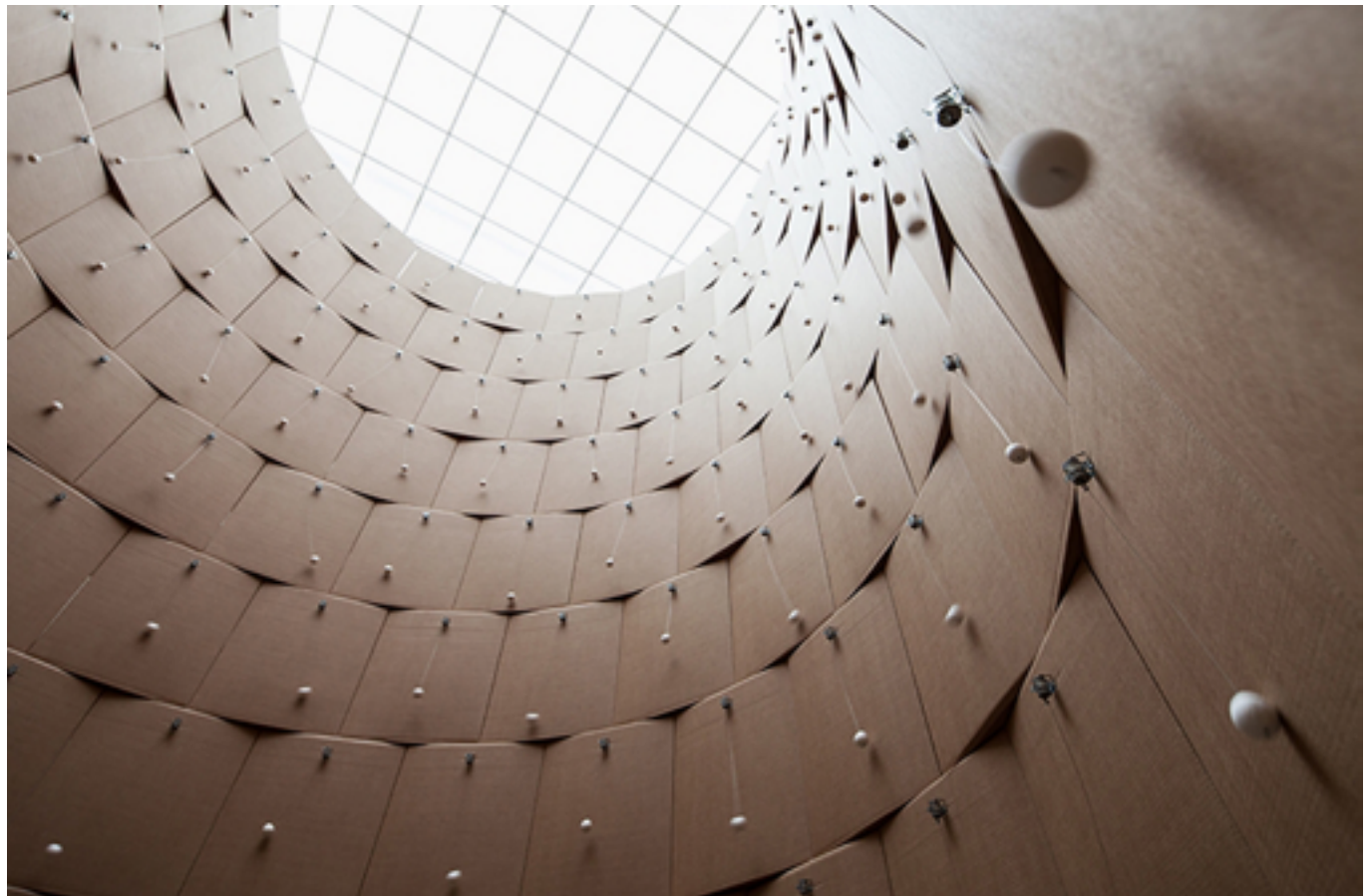
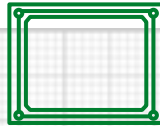
☐ If the children were to add more decorative details to the outside, for example more cardboard shapes, can they predict how this would affect the sound?

**ZIMOUN**

[www.zimoun.net](http://www.zimoun.net)

**Zimoun** (born in 1977, Switzerland) is an artist working with installation and sound, who creates mechanical sound sculptures from common industrial objects such as plastic bags, cardboard boxes and motors without microphones or speakers. What you hear is what you see.

Exploring mechanical rhythm, his installations 'platforms of sound'. The constant acoustic hum produced by these constructions creates a sonic and visual chaos out of what appears to be order.



Zimoun, *186 prepared dc-motors, cotton balls, cardboard boxes 60x60x60cm* 2013.



# Everyday sounds and how they are made

In this activity children will use everyday objects to develop their knowledge of sound and explore how to change the pitch of a sound. Children can then continue working on their instruments from Activity 2, exploring how they can create different pitches by manipulating found objects and materials to create a Body of Sound sculpture inspired by Pablo Picasso's work.

## National curriculum

### **SCIENCE OBJECTIVES**

Pupils should be taught:

- ☐ To find patterns between the pitch of a sound and features of the object that produced it.

### **ART AND DESIGN OBJECTIVES**

Pupils should be taught:

- ☐ To explore how different materials create different sounds, and how these can be matched to ideas and intentions.
- ☐ To compare ideas, methods and approaches in their own and others' work and say what they think and feel about them.
- ☐ To develop technical skills in using cardboard and masking tape to construct 3D work.

## RESOURCES

- ☐ Plastic rulers
- ☐ Glass bottles
- ☐ Water
- ☐ Straws
- ☐ Masking tape
- ☐ Cardboard boxes
- ☐ Elastic bands
- ☐ Cardboard



## TEACHER'S NOTE:

👉 **Ruler twanging** – the end of the ruler protruding over the edge of the table is vibrating. As this length is increased the pitch gets lower.

👉 **Bottle tapping** – the bottle and water are vibrating. As more water is added the sound gets lower.

👉 **Bottle blowing** – the air in the bottle is vibrating. When water is added to the bottle there is less air vibrating in the bottle and the pitch gets higher. (NB the opposite effect to bottle tapping)



👉 **Straw pan pipes** – the air inside the straw is vibrating. The longer the straw's length, the more air there is inside the straw to vibrate, thereby producing a lower note.

👉 **Elastic bands stretched over a box** – the thicker the elastic band, the lower the note produced. If the band is held at its centre, only half of the band vibrates, thereby producing a higher note. This example has an added complexity in that the tightness/slackness of the band will make a difference. As the band is pulled tighter a higher note is produced.





Picasso, Pablo (1881-1973): *Guitar (Paris, after March 1914)*. New York, Museum of Modern Art (MoMA). Construction of sheet metal and wire, 30 1/2 x 13 3/4 x 7 5/8' (77.5 x 35 x 19.3 cm). Gift of the artist. 94.1971 © 2015. Digital image, The Museum of Modern Art, New York/Scala, Florence

- 1 Set up all five activities on the Resource Sheet.
- 2 Recap over how the children were asked in Activity 1 to listen very carefully for nearby sounds.
- 3 Ask them to listen again for nearby sounds, but this time to think about whether the sound is a high pitch or a low pitch.
- 3 The children should form five groups and rotate around the carousel of activities with the following questions in mind:
  - a What is vibrating?
  - b How can you change the pitch of the sound?

#### NEXT STEP

- 1 Inspired by what they have learnt about how to change the pitch of sound produced by an object, look at Picasso's cardboard sculptures.
- 2 Referring back to the activities just tested, ask the children as a class which

activity does Picasso's work remind them of? For example, Picasso's string resembles a guitar string and is similar to the elastic band box they created.

- 3 Ask the children to imagine they are creating a 'Body of Sound' sculpture, and to consider how they could incorporate at least three of the previous activities into a sculpture that resembles a human body.

#### TEACHER'S NOTE:

For example, you could use a cardboard box as the body, stick straw pipes at the top for a nose, use the elastic band box for a stomach, rulers for ribs or feet, perhaps the bottles for a heart etc.

- 4 Using images of Picasso's work, ask the children to draw designs of their 'Body of Sound' sculpture using the cardboard box as the starting point.

As they design their work, ask:

- a** What form will their work take and what different shapes will it include?
- b** What is the scale of their sculpture and how will this affect the sound and pitch?
- c** How will the sculpture have enough weight for it to stand up?
- d** What additional decoration can they add to the outside and what sounds would these make? For example, cardboard ridges around the outside produce a sound.
- e** How are the different sound objects attached, and how does this affect the sound – for example, if tape is being used, does this muffle the sound? Why does this happen?
- 5** If there are materials and time to spare, ask the children to create their designed ‘Body of Sound’ sculpture.

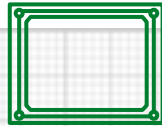
**SCIENCE**

- ☐ Can the children demonstrate how to change the pitch of different sound sources?
- ☐ Can the children talk about the cause and effect of the changes?
- ☐ Can the children make predictions for other sound sources that they have not explored?

**ART AND DESIGN**

- ☐ Can the children discuss how they investigated, recorded and developed ideas by collecting information in sketch books, using key words including shape and form?
- ☐ Can the children describe the different materials they used, and how they would/did create their art work?
- ☐ Would the children adapt their designs after discussing, comparing and learning from own and others work?



**PABLO PICASSO**

**Pablo Picasso** (1881-1973) was a Spanish artist who had an enormous impact on the development of art in the 20th century. Working in a variety of styles and mediums, Picasso was closely associated with many art movements, and produced a very diverse body of work over his lifetime.

Cubism was an art style created by Picasso and his peer Georges Braque (1882-1963) between 1907 and 1914. The Cubists did not agree that art should copy nature, or that a traditional still life, with its fixed viewpoint, was a convincing way to represent reality. When we look at an object we are rarely still, and instead we actively see it from a number of angles and positions.

The Cubists therefore wanted instead to emphasise the flatness of the painting surface. They did this by breaking an object up into geometric forms and then realigning these from multiple perspectives.

In 1912, Picasso made his first sculpture of a guitar out of cardboard. It was considered a radical leap from the sculptural traditions of carving or casting to a new technique of assembling using found, worthless materials.

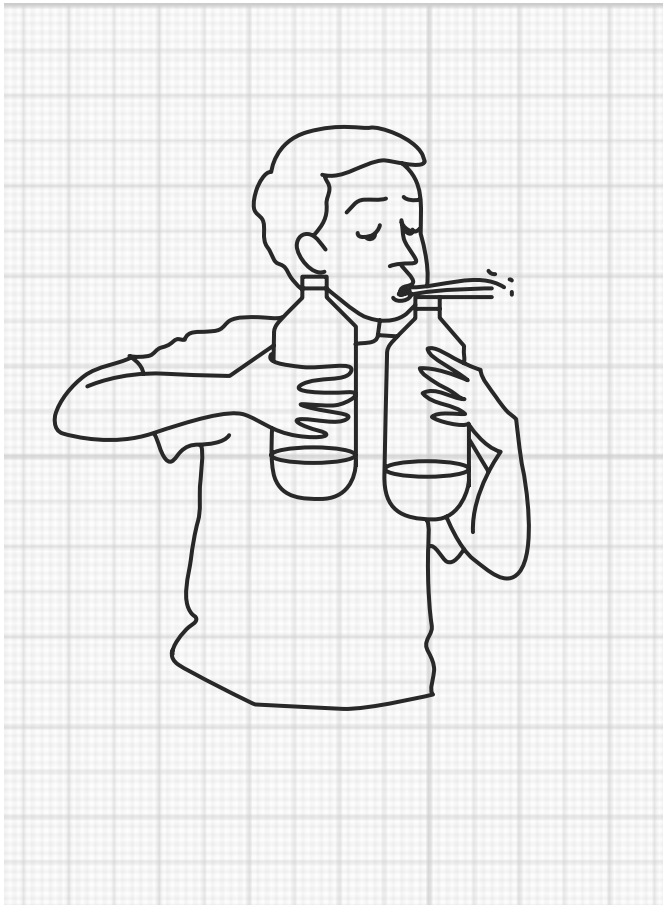
Sources:

<http://www.moma.org/interactives/exhibitions/2011/picassoguitars/picassos-studio/03.php>

[http://www.metmuseum.org/toah/hd/cube/hd\\_cube.htm](http://www.metmuseum.org/toah/hd/cube/hd_cube.htm)



Picasso, Pablo (1881-1973): *Guitar (Paris, after March 1914)*. New York, Museum of Modern Art (MoMA). Construction of sheet metal and wire, 30 1/2 x 13 3/4 x 7 5/8' (77.5 x 35 x 19.3 cm). Gift of the artist. 94.1971 © 2015. Digital image, The Museum of Modern Art, New York/Scala, Florence

**BOTTLE BLOWING**

- 1 Blow over the top of the bottle carefully.
- 2 What is vibrating?
- 3 How can you change the pitch of the sound?

**BOTTLE TAPPING**

- 1 Tap the bottle gently.
- 2 What is vibrating?
- 3 How can you change the pitch of the sound?

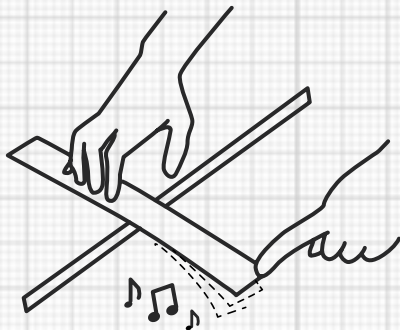


**RULER TWANGING**

1 Hold the ruler on the edge of the table. Gently press the end of the ruler down and release

2 What is vibrating?

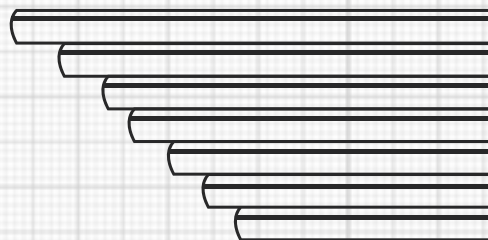
3 How can you change the pitch of the sound?

**STRAW PAN PIPES**

1 Blow over the top of the straws

2 What is vibrating?

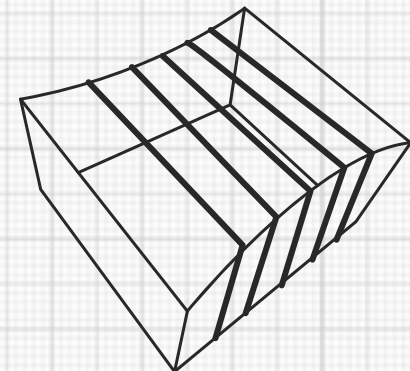
3 How can you change the pitch of the sound?

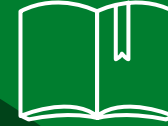
**ELASTIC BAND BOX**

1 Pluck the bands

2 What is vibrating?

3 How can you change the pitch of the sound?





# How does sound travel and how far does it go?

In this activity, working in a hall or outdoors, children will explore how sound travels in all directions and how far it travels. Using diagrams with coloured shapes of fading tone and direction lines, children will look at how they can visually represent their experiments.

## National curriculum

### SCIENCE OBJECTIVES

Pupils should be taught:

- ☐ Recognise that sounds get fainter as the distance from the sound source increases.
- ☐ Identify how sounds are made, associating some of them with something vibrating.
- ☐ Recognise that vibrations from sounds travel through a medium to the ear.



**RESOURCES**

- ☐ Constant volume sound source e.g. mobile phone ring tone, alarm, buzzer
- ☐ Large space
- ☐ Tape measure, metre stick or trundle wheel
- ☐ Coloured paper
- ☐ Camera
- ☐ Glue
- ☐ Paper
- ☐ Crayons



1 Measure out equal distances – so a marker every one metre – across the hall in a semi-circle shape.

2 Students should stand on this line, with each metre marker holding a different coloured piece of paper (so blue paper for students at 1 metre, yellow at 2 metres and so forth)

3 The teacher will stand at the front of the hall and play a sound. If the students can hear it they hold up their piece of paper.

✎ Continue testing out the activity with sound sources of different volumes, photographing each result.

**NEXT STEP**

1 Recap the previous activity, in which students were exploring how far sound travels and how it is harder to hear the further you are away from the sound source because the loudness decreases.

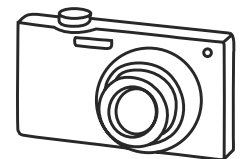
Q Ask the children to think about how they can gather evidence to prove that this is true.

2 Provide the children with sound and distance measuring equipment and ask them to plan how they will gather evidence.

Q Ask them to draw a diagram, including images of their sound source, to show what they will do.

✎ The investigation is best carried out in a large open space. Depending on the space available, it may be necessary to take a group out at a time to try out their method.

3 Plot out and mark on their diagram how far the sound travelled. This might be done using circles of colour, one colour for each sound tested, with the colour getting lighter as it travels further.



## NEXT STEP

❶ Split the class into two groups. One group will be 'the sound source', another 'the vibrations'. Choose one child to be an 'ear'.

❷ The 'sound source' group will stand at one end of the room and 'the ear' at the other. The 'vibrations' group assemble by the 'sound source' group. When the 'sound source' group starts to make a noise, the 'vibrations' move outwards. The children will probably all move towards 'the ear'.

🗨 Ask another child to be an 'ear' in a different place. Repeat the exercise. Hopefully some children will now travel to the second 'ear'.

Keep adding further 'ears' until the children realise that the vibrations travel out from the sound source in all direction. If a vibration travels to a place with no ear, the sound still reaches that spot but is not heard.



❸ The 'sound source' group will be given an example of a sound at a constant volume, e.g. an alarm bell. The 'sound source' group will then have to work out how big the vibration will need to be. Once decided, they will then pass this on to the 'vibrations' group. The 'vibrations' group must then move to the distance they think it will travel to - which 'ear' children hear the sound? I.e which 'ears' do the 'vibrations' reach and which not?

## NEXT STEP

❶ Ask them to consolidate their learning by presenting their results. This might be done in this way:

Ⓐ By continuing to work on their diagram, adding in photographs of the children and the sound source, which can be cut up and collaged onto a large piece of paper to represent the findings from their science experiment.

Ⓑ By using wax crayons to add in details from their findings, for example direction lines to indicate how far sound travelled.



## SCIENCE

- ☐ Can the children explain the method they will use to gather evidence?
- ☐ Can the children record their evidence systematically?
- ☐ Can the children explain whether their results support the explanation?



## ART AND DESIGN

- ☐ Can the children demonstrate how well sound travelled using tones of colour and lines?
- ☐ Can the children describe and discuss how they represented the way sound decreases the further away they are from the source?
- ☐ On looking at the other children's work, can they describe other ways of representing their findings?





# How do we hear sounds differently?

Linking to exhibiting artist Alistair McClymont's work, in this activity children will work scientifically to create their own experiment to explore how we hear sound differently. Starting with experiments involving the whole class and teachers/teacher assistants, the group will be asked what sounds they can hear. Through a series of true/false questions, students will begin to question if sounds are heard differently depending on a person's age etc. Children will then set up their own experiment to explore further and use collage and photograph to create a display in order to communicate their findings to other people.

## National curriculum

### SCIENCE OBJECTIVES

This lesson is not meeting a knowledge objective in the National Curriculum, but is an enrichment activity which involves working scientifically.

### ART AND DESIGN OBJECTIVES

Pupils should be taught:

- ☐ Asking relevant questions and using different types of scientific enquiries to answer them.
- ☐ Gathering, recording, classifying and presenting data in a variety of ways to help in answering questions.
- ☐ Reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions.

## RESOURCES

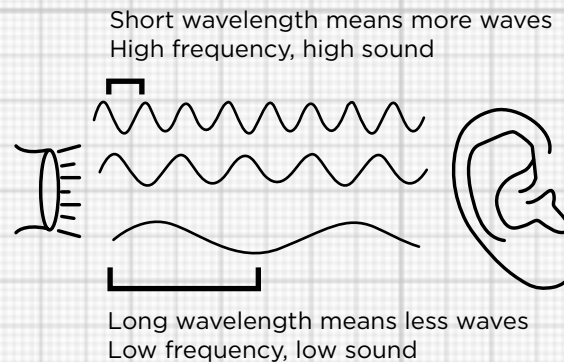


- ☐ Access to a computer or iPad that generates sounds of different frequencies
- ☐ <https://itunes.apple.com/gb/app/signal-generator-audio-test/id543661843?mt=8> for iPads (free)
- ☐ <http://onlinetonegenerator.com/> website for all internet browsers
- ☐ Samples of sounds at different pitches
- ☐ Small pieces of card
- ☐ Pencil
- ☐ Blue tac

## TEACHER'S NOTE:



Children can hear notes of a higher frequency and it may hurt their ears, so remember not to leave high frequency notes playing for too long even though you may not hear them.



1 Play video <http://www.bbc.co.uk/education/clips/zrfpyrd>

👉 In this clip you can hear the sound of a New York subway train as it would be heard by a child and then again but as an elderly person would hear it. What is the difference?

2 Explain that you are going to play a sound using a sound generator which produces sounds of different pitch.

🗣 Ask the whole class (including the adults) to stand up each time they hear a sound.

3 Play a sound and test again, increasing and decreasing the frequency to produce notes of different pitches.

👉 At this point it will become clear that there is a difference to what children and adults hear.

4 Provide the statements from Resource Sheet 1 (these should be cut up in advance).

5 Ask the children in small groups or pairs to think about whether the statements are true, sometimes true, or false.

6 Some statements do not refer to hearing sounds of different pitch. Ask the children to identify these and put them aside.

7 Ask the children to turn the remaining statements about pitch into questions that can be investigated. How could these questions be investigated as a class?

Each group should select a question to investigate and decide what they will need to do to gather evidence to answer it.

8 Each group gathers evidence to answer their question and then presents their findings to the class.

Their findings can be presented by creating small drawings of people on 5cm piece of card, using blue tack to hold the drawing up, and placing these in locations that they will need to stand to hear a sound source.

#### OPTIONAL EXTENSION ACTIVITY:

1 Watch this clip as a class, exploring Audio Illusions:

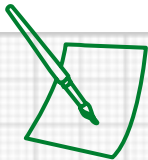
a Can You Trust Your Ears? (Audio Illusions) <https://www.youtube.com/watch?v=kzo45hWXRWU>



#### SCIENCE

- ☐ Can the children turn the statements into questions to be investigated?
- ☐ Can the children identify which questions can be investigated?
- ☐ Can the children decide on how to gather suitable evidence to answer their question?
- ☐ Can the children gather suitable evidence and look for patterns in their evidence?
- ☐ Can the children talk about any patterns they noticed in their evidence?
- ☐ Can the children use the evidence to answer their question?

TRUE / FALSE STATEMENTS



STATEMENTS	TRUE	FALSE
1 Girls can hear higher sounds than boys.		
2 Boys can hear lower sounds than girls.		
3 Girls can hear a wider range of sounds.		
4 All children can hear the same range of sounds.		
5 Younger children cannot hear high sounds.		
6 Older people cannot hear high sounds.		
7 As you get older the range of sounds you hear decreases.		
8 Older people cannot hear quiet sounds.		
9 Children hear more clearly.		
10 People go deaf when they get old.		

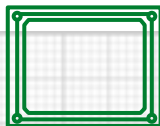


**ALISTAIR MCCLYMONT**

[www.alistairmcclymont.com](http://www.alistairmcclymont.com)

Exhibiting artist Alistair McClymont's work *One should never mistake pattern ... for meaning. (Function Generator)* explores the connection we have with sound from scientific perspectives through to its use in contemporary music. Developed in collaboration with neuroscientist Aleksandra Berditchevskaia and teachers from Griffin and Falconbrook primary schools, sound resonates through the gallery space. McClymont has set the art work up as an ongoing project involving experiments in collaboration with Berditchevskaia, and live performances with scratch DJ and producer Prime Cuts and artist and musician Tom Richards.

<http://www.alistairmcclymont.com/artwork/one-should-never-mistake-pattern-meaning>



Alistair McClymont, *One should never mistake pattern...for meaning (Function Generator)* 2015 ©Eion Carey



## What does sound look like?

Consolidating what the children have learnt about how sound travels, how far it travels and how we hear sounds, the children will create soundscape images in response to a selected music piece. Exploring mark-making techniques and inspired by the artist Andie Clay's work, the children will look at how we can visualise sound and how sounds make us feel. This work will be linked to exhibiting artist Alistair McClymont's work at the gallery, where he questions if how we see sound affects how we hear it.

### National curriculum

#### **MUSIC OBJECTIVES**

Pupils should be taught:

- ☐ To listen with attention to detail and to recall sounds with increasing aural memory.

#### **ART AND DESIGN OBJECTIVES**

Pupils should be taught:

- ☐ To develop practical skills using drawing and mark-making by experimenting with a range of materials, including paint, pencils and other mark-making tools.
- ☐ To select, and use appropriately, the materials and techniques in order to create their own work, taking the time to reflect upon the connections between the mark created and the volume and pitch of the sound.
- ☐ To be able to communicate observations, ideas and feelings in reference to Andie Clay's artwork and their own work, linking to key terms including line, shape and colour.



**RESOURCES**

- ☐ Clip of simple music
- ☐ Drawing and mark-making media: pencils, brushes, chalk pastels, paint, charcoal, mono printing inks etc.
- ☐ Large sheets of plain paper



1 Play excerpts of music and ask the children to describe what they hear and how the excerpts differ. Write down and display these words.

☞ Ensure that you elicit the following keywords:

**High – low**  
**Fast – slow**  
**Loud – quiet**  
**Short – long**

2 Show the children examples of Andie Clay's artwork, and explain that the work is inspired by listening and responding to sound and music.

3 Select one excerpt of music and encourage the children to start thinking about:

a Sound and colour: If this sound was a colour, what colour it would be?

b What words best describe the sound, e.g. is the sound calm/sharp/wavy/empty/loud/dense/light/far away/close/melodic/soft/angry/filling/emotive etc.?

4 Demonstrate various techniques of mark-making that can communicate some of the descriptive words just discussed.

☞ For example, drawing in a very fast way with heavy pressure could convey 'loudness'.

🗣 Reflect on what has been learnt about how sound vibrates, pitch, and how far sound travels and discuss how you would show a loud sound or a quiet sound?

5 The children should now experiment themselves with mark-making in colour and monochrome in response to music on A1 paper.

6 As a group, discuss the results and what each mark expresses.

Q For example:

a Does a dot suggest it was a short sound? Or that it was quiet? Add descriptive words to the artwork.

7 Taking a short sound piece, create a sound scape using different marks and images. This can be done:

a In small groups, with each child taking a different part.

b Using lines from traditional sheet music.

c Using coloured paper to cut out different shapes.

8 On completion, ask the children to describe their work to the rest of the class.



### ART AND DESIGN

☐ Can the children describe the marks that they made and why they made them, using the keywords colour, shape, line and pattern?

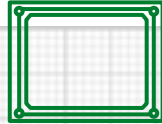
☐ Can the children discuss how their image would look different if they used a different colour? From this, can they say what the most appropriate colour is and why?

☐ After discussing it with the class, can the children identify any areas that they would change and why?

**ANDIE CLAY**

[www.andieclay.com](http://www.andieclay.com)

Andie Clay's paintings of both music and musicians performing owe much to a love of music. Experience of playing piano and guitar and taiko drumming informs her artwork, exploring her personal interpretation of the musical score. Her paintings aim to capture the whole experience of music.

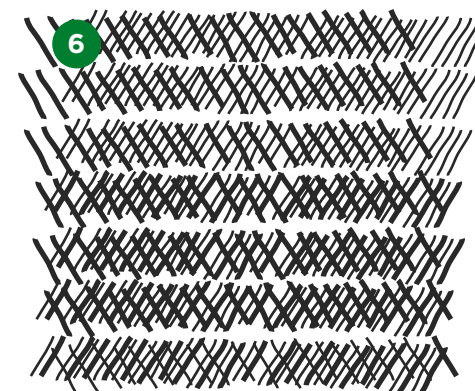
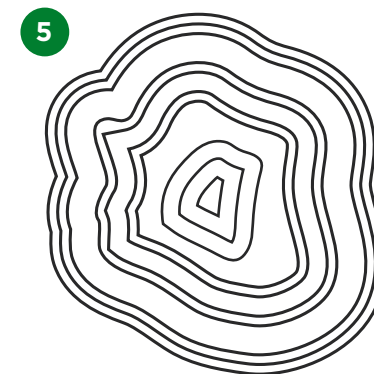
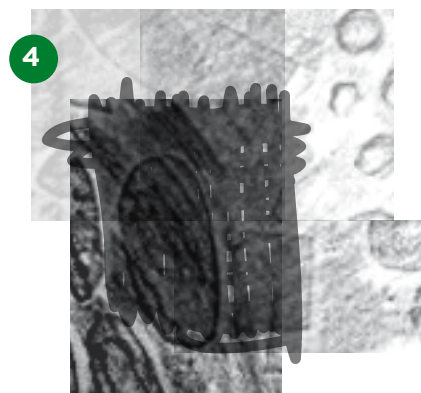
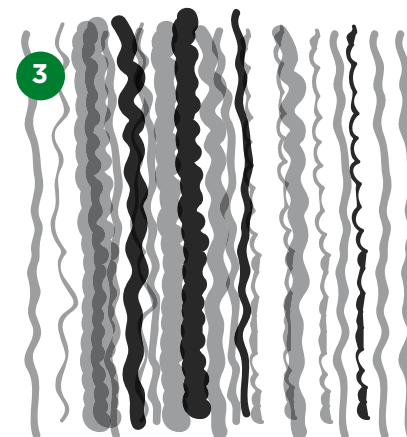
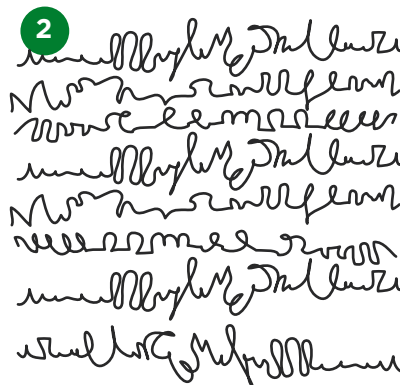
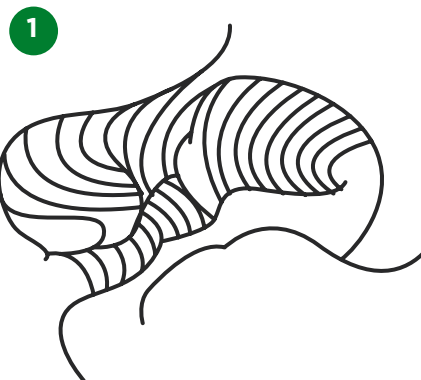
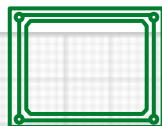


Andie Clay, *Rhythmscape 4 (Jan Garbarek)* - 64 cm x 64cm, mixed media  
© Andie Clay. All Rights Reserved, DACS 2015

### MARK-MAKING

Examples for mark-making techniques using a variety of media:

- 1 Pen/Felt Tip: wavy line/thick & thin/ flowing
- 2 Pen/Pencil: Continuous lines/ round and sharp shapes
- 3 Paint/Ink/Dry brush: squiggle/ pattern & texture
- 4 Mono Printing: Texture/Block/Tone
- 5 Card Relief: layer/pattern/gloss/ texture
- 6 Pencil: dot/hatch/cross/overlay/ dot/squiggle





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